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## REVIEWS OF RECENT LITERATURE.

- (1) ZOPF, DR. WILHELM.—*Die Pilze in morphologischer, physiologischer biologischer und systematischer Beziehung*. Breslau, 1890, pp. iii, 500, figs. 163. Eduard Trewendt.
- (2) KIRCHNER, DR. OSKAR.—*Die Krankheiten und Beschädigungen unserer landwirtschaftlichen Kulturpflanzen*. Eine Anleitung zu ihrer Erkennung und Bekämpfung für Landwirte, Gärtner, etc. Stuttgart, 1890, pp. x, 637. Eugene Ulmer.

(1) The frequent use of this book for more than a year and the recent careful reading of the whole of it preparatory to this review, have served to strengthen the first impression, viz, that for the general student it is the best handbook yet published. We miss throughout it is true, De Bary's classical style, and in places also his intimate knowledge and comprehensive grasp of details, but on the other hand there is a welcome absence of interminable minutiae, and a certain directness and subordination of the parts to the whole that more than compensates. Naturally our first thought is to compare the book with De Bary's *Morphologie*, but the two occupy different fields. De Bary concerns himself almost exclusively with structure, delighting in a wealth of detail, very useful to the specialist, but always very discouraging to the general student, especially if to the perplexities of the subject are added a condensed style and the difficulties of a foreign language, in this case now happily overcome for English readers by Garnsey's translation.

As the title indicates, this work is an effort to cover the whole ground of morphological, physiological, and systematic mycology and, considering the difficult nature of the task, it must be said that Dr. Zopf has succeeded admirably.

The preface is dated Halle a. S., May, 1890, and the book is dedicated "*Dem Andenken von E. Fries, Tulasne, De Bary.*"

The book is divided into six chapters, and perhaps no better idea can be given of the scope of the work than to translate the running heads of the chapters devoted to morphology, physiology, and biology.

Chapter I, in 27 pages discusses *The morphology of the vegetative organs*: Typical mycelium—sprout mycelium—haustoria—climbing mycelium—sclerotia—mycelial strands and pellicles—reduced mycelium.

Chapter II, in 68 pages, discusses *The organs of fructification*: Exosporous or conidial fructification, nature of conidia and mode of formation—forms of conidial organs—simple conidiophores—conidia bundles—conidia beds—conidia fruits; endosporous or sporangial fructification—simple sporangiophores—sporangial beds—sporangial fruits—structure of the mature ascus fruit—development of the sporangial fruits; zygosporous fructification; gemma (brood cells, chlamy-

dospores); monomorphism, dimorphism, pleomorphism; *Mechanical arrangements for liberating the spores*: The loosening of the conidia from each other and from their supports—the expulsion of conidia, sporangia, and fruit-forming organs—the liberation of endospores from the sporangia of the Phycomycetes—the ejaculation of spores from asci—liberation of conidia from pycnidia—liberation of ascospores from the non-ejaculatory Ascomycetes.

Chapter III, in 20 pages, treats of *Cell structure*: The membrane thickenings—foldings—differentiations—chemical nature—physical nature; plasma; cell division. *Cell formation*: Free cell formation; cell division. *Union of cells into systems (tissues)*: Cell threads—cell surfaces—cell masses—hyphal tissues—fusion formation (fusion tissue).

Chapter IV, in 109 pages, treats of *The Chemical composition*: Inorganic; organic—carbohydrates—vegetable acids—aromatic acids (tannins, acids of lichens)—fats—ætherial oils—resins—colors (yellow or yellow-red oleaginous colors, *i. e.*, lipochrome)—colors not due to lipochrome—reds—greens—blues and blue greens—violets—browns—combinations with each other and with other substances—the distribution of particular colors—change of color—glycosides—plant bases (alkaloids)—cholesterin—albumen. *Foods*: Inorganic—organic—composition and combinations—chemical reactions. *Transformation, storage, secretion*: Ferments (enzymes)—inverting—starch dissolving—paramylum dissolving—cellulose dissolving—peptonizing—fat splitting—chitin dissolving; resin-like bodies and ætherial oils; colors and chromogenes; secretion of albumen and peptone; secretion of sugar; oxalic acid; other acids; ammonia; water. Respiration; fermentation (splitting—oxidation); splitting up of food materials; production of heat; production of light. *Influence of external forces on growth, fructification, etc.*: Light—temperature—mechanical movement—atmospheric pressure. *Phenomena of movement*: Heliotropism—hydrotropism—geotropism—movements due to contact—rheotropism—chemical irritation—electrical irritation—nutration—hygroscopic movements. *Life activity and life injuring agents*: Extremes of temperature—removal of water—insolation—poisons. *Mechanical means of killing or hindering development*.

Chapter V, in 57 pages, treats of the *Biology of fungi*, under the following heads: *Saprophytes*; *Parasites*: The transportation of infectious fungus germs; means and way of infection; choice of host—choice of organ; effect of parasitism in plants and animals—hypertrophy—metamorphosis—production of new growths—pseudomorphosis and mummification—destructive action; a glance at the diseases of men and animals due to fungi—invertebrates, vertebrates—fishes—birds—mammals—man; battle of the animal cells and tissues with the penetrated fungous cells. *Symbiosis*: The enemies of fungi—enemies of molds—of Saprolegniaceæ—of rust fungi—of Hyphomycetes—of Ascomycetes. *Duration of life*.

The reader who wishes a digest of what was known up to 1890 on any of these subjects can not do better than to consult this book, for if he does not there find all he needs the chances are that the footnote references to the literature of the subject will put him in the way of finding the rest.

The last half of the book is devoted to a presentation of the systematic side of mycology. An account is given of each of the groups, and this is followed by a description of some of the more important genera. Naturally views differ as to classification. The most radical change, and one which will probably not meet with general acceptance is the exclusion of *Synchytrium*, *Woronina*, *Olpidiopsis*, *Rozella*, etc., on the ground that the production of a vegetative plasmodium is entirely foreign to the eu-mycetes, and allies these organisms to the Myxomycetes and other forms which the author follows De Bary in considering to be animals.

The groups and families in Dr. Zopf's classification are arranged as follows:

- |                          |                          |
|--------------------------|--------------------------|
| I. PHYCOMYCETES.         | (MYCOMYCETES—continued). |
| 1. Chytridiaceæ.         | (f) Agaricaceæ.          |
| (1) Olpidiaceæ.          | (3) Gasteromycetes.      |
| (2) Rhyzidiaceæ.         | (a) Hymenogastreæ.       |
| (3) Chladochytriaceæ.    | (b) Sclerodermiaceæ.     |
| 2. Oomycetes.            | (c) Lycoperdaceæ.        |
| (1) Saprolegniaceæ.      | (d) Nidulariaceæ.        |
| (2) Ancylistiaceæ.       | 2. UREDINEÆ.             |
| (3) Peronosporæ.         | 3. USTILAGINEÆ.          |
| 3. Zygomycetes.          | 4. ASCOMYCETES.          |
| (1) Mucoraceæ.           | (1) Gymnoasceæ.          |
| (2) Chætocladiaceæ.      | (a) Saccharomycetes.     |
| (3) Piptocephalideæ.     | (b) Exoasceæ.            |
| (4) Entomophthoræ.       | (c) Gymnoasceæ.          |
| II. MYCOMYCETES.         | (2) Perisporiaceæ.       |
| 1. Basidiomycetes.       | (a) Erysipheæ.           |
| (1) Protobasidiomycetes. | (b) Aspergilleæ.         |
| (a) Pilacreæ.            | (c) Tuberaceæ.           |
| (b) Auriculariaceæ.      | (3) Sphæriaceæ.          |
| (c) Tremellaceæ.         | (a) Sphæriaceæ.          |
| (d) Dacryomycetes.       | (b) Hypocereæ.           |
| (2) Hymenomycetes.       | (c) Xylariæ.             |
| (a) Hypochnaceæ.         | (d) Hysteriaceæ.         |
| (b) Thelephoraceæ.       | (4) Discomycetes.        |
| (c) Clavariæ.            | (a) Pezizaceæ.           |
| (d) Hydnaceæ.            | (b) Helvellaceæ.         |
| (e) Polyporaceæ.         |                          |

The author differs from Brefeld in keeping *Gymnoascus* among the *Gymnoasceæ*; from Rehm in classing *Hysteriaceæ* under *Sphæriaceæ*; from Fischer and most of the recent systematists in including *Plasmodium*, etc., under *Peronospora*; and from Schröter in excluding *Myxomycetes*, etc., on the grounds already stated.

The appendix is devoted to an interesting account of the following fungi imperfecti:—*Torula*, *Mycoderma cerevisiae*, *Monilia candida*, *M. albicans*, *Dematium pullulans*, *Oidium schænleinii*, *O. quinckeanum*, *O. tonsurans*, *Hormodendron cladosporioides*, *Cladosporium herbarum*, *Sep-  
tosporium bifurcum*, *Stachybotrys atra*, and *Arthrobotrys oligospora*. The book concludes with a list of errata (by no means complete), a list of illustrations, and a general index. It is printed in clear Roman type, on good paper, and except for the half-paper cover, which does not wear well, is, like most German books, well bound. The illustrations are especially praiseworthy, not so much for mechanical execution, wherein some are inferior, as for the care with which they have been selected to illustrate particular features, and the fact that most of them have not been hackneyed by repeated use in other books. The illustrations are also numerous enough, by the union of many distinct figures into one so-called figure, to give a good general notion of the whole subject of fungi.

In several cases there is an omission of important facts which should appear in a work of this character, *e. g.*, Jensen hot water treatment for smut of oats and wheat, or Humphrey's discovery of cilia on the swarm spores of *Achlya*. Occasionally also there is a slip, *e. g.*, on page 90 the term "*epiplasm*" is attributed to De Bary with a different meaning from that given in his *Morphologie*, *i. e.*, De Bary uses it for glycogen mass, but it is here used to designate the residual protoplasm in free cell formation, for which De Bary's own term is "*periplasm*;" on pp. 386 and 397 the genus *Endophyllum* is said to possess no teleutospores, but to have æcidiospores which germinate with the formation of a promycelium and sporidia, all of which might have come from a superficial consideration of the arrangement of the spores or from a hasty reading of Winter's description (*Pilze* i. p. 251), but which can scarcely be admitted if we are to attach any definite meaning to the term *teleutospore*; on p. 439 *Gymnoascus reesii* is said to be the only species of the genus, whereas Winter gives 3 and Saccardo 6. Such causes for complaint are, however, comparatively few, the bulk of the errors consisting of transpositions, slight omissions, incorrect numbering of descriptions (*e. g.*, fig. 74), and wrong cross-references. Of the latter there are at least a hundred, a very considerable number for a book of reference. Happily, so far as observed, these mistakes do not extend to the index, or the references to literature which are quite copious. This book was evidently first issued as part of a larger work of some sort (*Schenck's Handbuch?*) and then repaged for issue in the present form, and the errors are probably attributable to want of care in the revision.

The treatment of the whole subject of conidia and of the special group *Saccharomycetes* is of particular interest, but to readers already familiar with De Bary, the chapters devoted to physiology and biology will no doubt seem freshest, while to the beginner the 200 pages devoted to

classification must prove invaluable and alone worth many times the price of the book. So far as known to the writer, there is no other book in any modern language in which the student just commencing the study of fungi can find so good a résumé of what is absolutely essential for him to know. If he masters this one book he will have laid an excellent foundation for future studies of special monographs, and of that vaster book never to be included in any monograph.

(2) Dr. Kirchner's book occupies an entirely different field from the preceding. The plan is also quite unlike that followed in the handbooks of Frank and Sorauer. In fact the book is unique in the literature of plant diseases. In his preface the author regrets that knowledge of plant diseases and injuries is so little diffused among practical men, the very class who need it, and ascribes this in part to the fact that their study leads at once into the most difficult departments of two sciences, botany and zoölogy, and requires more time and more special knowledge than is at their command.

By keeping constantly in view the needs of farmers and gardeners, the author has succeeded in overcoming many of the difficulties and making a very practical, useful book. Theoretical considerations and technical expressions are excluded as far as possible, and a commendable effort has been made to combine simplicity with perspicuity and accuracy. In a book of this character it is of course impossible to avoid errors, and some have crept in, but there are not enough to seriously injure its usefulness. No claim is made to completeness, but nevertheless a great amount of interesting and valuable information has been well digested and put together in a very accessible form, and the general accuracy of statement is especially commendable. It is a book to save the busy man's time by answering as quickly as possible the following questions: (1) What ails the plant? (2) How can the trouble be remedied? The author has not confined himself to prominent diseases or to those due solely to vegetable parasites, but has made a praiseworthy effort to mention all, and the reader is therefore likely to find a paragraph touching any disease or injury on which he may wish enlightenment, provided, of course, it is one that occurs in middle or northern Europe.

The book is divided into two parts, the first 368 pages being an artificial key to the diseases and injuries of agricultural plants, arranged under the following heads: Cereals 14, edible Leguminosæ 6, grasses 20+, forage plants 25+, roots 4, commercial plants 12, vegetables and kitchen plants 27, fruit trees 11, berries 6, and the vine 1—total 126. The diseases attacking these 126 plants are classified according to gross appearances and according to the parts they attack. For example, 17 pages are devoted to the diseases of *Vitis vinifera*, arranged in the following way: I. Diseases and injuries of the leaves, II. diseases and injuries of the buds and shoots, III. diseases and injuries of the branches, IV. diseases and injuries of the old wood, V. diseases

and injuries of the roots, VI. diseases and injuries of the flowers and flower buds, VII. diseases and injuries of the berries. Under each of these groups are as many lettered or numbered divisions and subdivisions as may be necessary to include all of the diseases, one paragraph being given to each, with a numeral cross-reference to Part II, where a scientific description of the parasite may be found. When possible, classification is carried still farther, *e. g.*, under VII. diseases and injuries of the berries, the following subdivisions are given:

A. Rot of the berries.

*a-e.*—Five paragraphs devoted to as many diseases.

B. Spots which hinder development, and sometimes completely destroy the berry, caused by fungi, which also occur on the leaves.

*a-g.*—Seven paragraphs.

C. Spots of varied color which do not noticeably affect the growth and ripening of the berries.

*a-d.*—Four paragraphs.

D. Injuries by insects.

*a-d.*—Four paragraphs.

E. Dwarfing, protrusion of seeds, etc.

In Part II, under the appropriate classes, groups, orders, and families, there is a concise description of 1,332 injurious species, 423 of which are parasitic plants, mostly fungi, the descriptions of which are drawn principally from Saccardo, Winter, and Schröter. These 1,332 species are numbered serially, corresponding to the cross-references in Part I. A concise account is also given of the classes, orders, families, and genera to which these species belong, so that this part of the book is really a very serviceable compendium of parasitic plants and animals.

On the whole, this is the best book extant for the rapid determination of unknown plant diseases, and will therefore be of much use to students. The book would have had a wider circle of readers and have been still more useful if the author had included shade trees and all cultivated plants. Notes on treatment are given wherever anything definite has been ascertained, but this is the weakest part. The book is provided with a table of contents, an index to names, and a special index to technical terms.—ERWIN F. SMITH.

**RUST IN WHEAT.**—Report of the proceedings of the conference, convened by invitation of the Minister for Agriculture (the Hon. Sidney Smith), and held in Sydney [New South Wales] on June 2, 3, 4, 5, and 8, 1891. Sydney, Charles Potter, government printer, 1891. Folio, pp. 56, pl. 1.

The subject of rust in wheat has of late years excited the liveliest interest in the Australian colonies. According to a statement of the Minister for Agriculture, the total loss from the disease amounts to about £2,000,000 annually, and naturally a desire is felt to find some way of combating it. During the year 1890 many experiments were carried on. Details of these are given in the report of the conference convened at Sydney in June, 1891, at which delegates from the four